

What is claimed is:

1 1. A method for filling a uniform mask layer in a trench
2 of a trench capacitor, comprising:

3 providing a semiconductor substrate, wherein the
4 semiconductor substrate has a dense trench area and
5 a less dense trench area with a plurality of trenches
6 formed in both areas respectively;

7 forming a mask layer covering the semiconductor
8 substrate, wherein the trenches are filled with the
9 mask layer;

10 etching the mask layer at an angle until the dense trench
11 area and the less dense trench area in the
12 semiconductor substrate are exposed to leave the
13 mask layer in the trenches; and

14 etching the mask layers in the trenches, and a uniform
15 thickness of the mask layer in each trench is
16 achieved.

1 2. The method for filling a uniform mask layer in a
2 trench of a trench capacitor of claim 1, wherein the angle
3 is greater than 45 degrees relative to the normal angle.

1 3. The method for filling a uniform mask layer in a
2 trench of a trench capacitor of claim 1, wherein the mask layer
3 is a photoresist layer.

1 4. A method for filling a uniform mask layer in a trench
2 of a trench capacitor of a DRAM, comprising:

3 providing a semiconductor substrate, wherein a first
4 liner layer and a second liner layer sequentially

5 formed thereon, and the semiconductor substrate has
6 a dense trench area and a less dense trench area
7 with a plurality of trenches formed in both areas
8 respectively;
9 conformably forming a doped insulating layer covering
10 the second liner layer and the trenches;
11 forming a photoresist layer covering the doped insulating
12 layer and the trenches are filled with the
13 photoresist layer;
14 etching the photoresist layer at an angle until the dense
15 trench area and the less dense trench area in the
16 semiconductor substrate are exposed to leave the
17 photoresist layer in the trenches;
18 etching the photoresist layers in the trenches, and a
19 uniform thickness of the photoresist layers in each
20 trench is achieved;
21 etching the doped insulating layer using the photoresist
22 layers as etching masks until the exposed doped
23 insulating layer is removed to leave the doped
24 insulating layer in the trenches;
25 removing the photoresist layer; and
26 diffusing the doped insulating layers to form a plurality
27 of doped areas in the semiconductor substrate,
28 wherein the doped areas are substantially the same
29 in size.

1 5. The method for filling a uniform mask layer in a
2 trench of a trench capacitor of claim 4, wherein the first
3 liner layer is a liner oxide layer.

1 6. The method for filling a uniform mask layer in a
2 trench of a trench capacitor of claim 4, wherein the second
3 liner oxide layer is a liner nitride layer.

1 7. The method for filling a uniform mask layer in a
2 trench of a trench capacitor of claim 4, wherein the doped
3 insulating layer is an ASG layer.

1 8. The method for filling a uniform mask layer in a
2 trench of a trench capacitor of claim 4, wherein the angle
3 is greater than 45 degrees relative to the normal angle.

1 9. A method for forming a uniform bottom electrode in
2 a trench of a trench capacitor, comprising:

3 providing a semiconductor substrate, wherein the
4 semiconductor substrate has a dense trench area and
5 a less dense trench area with a plurality of trenches
6 formed in both areas respectively;

7 sequentially forming a first liner layer, a second liner
8 layer, a mask layer, and a patterned photoresist
9 layer with a plurality of openings, wherein a portion
10 of the mask layer is exposed via the openings;

11 sequentially etching the exposed mask layer, the second
12 liner layer, the first liner layer, and the
13 semiconductor substrate using the patterned
14 photoresist layer as an etching mask to form a
15 plurality of trenches in a dense trench area and
16 a less dense trench area;

17 sequentially removing the patterned photoresist layer
18 and the mask layer;

19 conformably forming a doped glass layer covering the
20 second liner layer and the trenches;
21 forming a photoresist layer covering the doped glass
22 layer, and the trenches are filled with the
23 photoresist layer;
24 etching the photoresist layer at an angle until the dense
25 trench area and the less dense trench area in the
26 semiconductor substrate are exposed to leave the
27 photoresist layer in the trenches;
28 etching the photoresist layer to a predetermined depth
29 in the trenches, and a remaining photoresist layer
30 is formed;
31 removing the exposed doped glass layer using the remaining
32 photoresist layer as a mask;
33 removing the remaining photoresist layer;
34 annealing the semiconductor substrate to form an ion doped
35 area as a bottom electrode in the semiconductor
36 substrate; and
37 removing the doped glass.

1 10. The method for forming a uniform bottom electrode
2 in a trench of a trench capacitor of claim 9, wherein the first
3 liner layer is a liner oxide layer.

1 11. The method for forming a uniform bottom electrode
2 in a trench of a trench capacitor of claim 9, wherein the second
3 liner oxide layer is a liner nitride layer.

1 12. The method for forming a uniform bottom electrode
2 in a trench of a trench capacitor of claim 9, wherein the mask
3 layer is a BSG layer.

1 13. The method for forming a uniform bottom electrode
2 in a trench of a trench capacitor of claim 9, wherein the doped
3 insulating layer is an ASG layer.

1 14. The method for forming a uniform bottom electrode
2 in a trench of a trench capacitor of claim 10, wherein the
3 angle is greater than 45 degrees relative to the normal angle.